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Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C. 20554

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Federal Communications Commission
Office of the Secretary

In the Matter of	)	RE: FCC 87-246
	)	
Advanced Television Systems RM-5811	)	
and their Impact on the	)	
Existing Television Broadcast	)	
Service	)	
	)	**MM Docket No. 87-268**
Review of Technical and	)	
Operational Requirements:	)	
Part 73-E, Television Broadcast	)	
Stations	)	
	)	
Reevaluation of the UHF Television	)	
Channel and Distance Separation	)	
Requirements of Part 73 of the	)	
Commission's Rules	)	

COMMENTS OF A-VISION™

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A-VISION™ is an organization engaged in the development of advanced television (ATV) and media related systems for application in several industries. In support of this wide-ranging FCC inquiry to consider the technical and public policy issues surrounding the use of advanced television technologies by television licensees, A-VISION™ includes and outlines some of the following issues, questions and comments.

1. Significant ATV Criteria for System Comparison and Evaluation

1.1 Compatibility of the Global System Architecture (GSA)

A First Goal: Globally Converging Compatible Architecture Systems (GCCAS)

The primary goal and requirement of the global system architecture is the evolutionary compatible convergence of the various significant systems (television, film, computer graphic and related media systems) toward a common globally-compatible open-architecture integrated system.

The advanced television global system architecture (ATV GSA) should not only provide the anticipated video/audio performance quality improvements with artifact-free, flicker-free TV display, but also should provide a way to more easily integrate any of the present global systems (both the 525 line NTSC systems and the 625 line systems), as well as more easily accomodate the various frame rates of television, film and related industries (including, for example, 24, 25, 30, 50, 60, 72 Hz and other frame rates).

In the ATV GSA, the active video image area should be on a binary-based system, and should be binary system compatible and extensible. The ATV GSA system should be compatible with the human visual system, compatible with and extensible to NTSC and other existing and anticipated systems, and be bandwidth efficient, friendly, and cost effective.

1.2 Audio Quality Performance

Higher quality and distortion free multiple channel audio is perceptually and practically even more important than the video. Highest quality in audio performance is easier, more cost effective, and more bandwidth efficient to provide, than the comparable highest quality in video.

CD digital audio quality is recommended, with a minimum of four channels, and preferrably there would be options for 6, 8, 10, or 12 channels to provide the high quality multilingual audio (and data) capability.

1.3 Video Quality Performance

Video quality performance points of reference span several ranges.

Currently, there is a moderately higher quality studio image which is then NTSC encoded and transmitted for display in the home. This transmitted TV display is of limited video quality, with the performance limited by a number of factors, including the television system scanning and encoding system and parameters that are used, the bandwidth limitations at various portions of the system, transmission system limitations, ghosts, noise, and similar considerations. The result is, at best, less than acceptable to many viewers; namely:

- the assumed 290 to 338 lines of vertical resolution
  (out of 483 active lines)
- up to 330-340 lines of horizontal resolution
  (corresponding to approximately 80 TV lines per MHz
  of available bandwidth, up to 4.2 MHz)

Proposed ATS extended definition (ED) systems would improve on vertical and horizontal resolution, and some proposed high definition (HD) systems would offer resolution improvement in each axis of approximately a factor of two. There would also be additional horizontal resolution elements corresponding to a 25% to 33% increase in picture width. Some HDTV systems propose an approximate 5 times increase of the information content, however requiring a five times increase in required bandwidth before any bandwidth compression is applied. Evolving ATV and bandwidth compression technologies could permit greater resolution improvements as well as other quality enhancements to become practical.

Both the computer graphics industry and the film industry provide good examples of what the video quality performance could be. The computer graphics industry already now regularly uses sequentually (or progressively) scanned high resolution displays, rather than the TV industry's present 2:1 interlace technology. High resolution non-interlaced (or progressively scanned) color display monitors are readilly available in the marketplace that provide at least 1024 pixels (1K pixels) in each image axis. Color monitors displaying 1024 by 1280 pixels are common, and monitors displaying up to 1200+ by 1600+ pixels are available. Color monitors capable of displaying up to 2K by 2K exist, although they are very expensive.

The motion picture film industry provides additional video performance quality points of reference, with 16 mm, 35 mm, and 70 mm film. Assuming that conventional current television was roughly comparable with 16mm film, ATS HDTV performance is often compaired with 35 mm film as a performance goal, and as a potentially interchangable media. A-VISION™ is engaged in the development of ATV systems that handle up to this video performance quality, and higher. On the high end is the 70mm Showscan™ film technology, with 60 frames/sec., displayed on a large (2:1) aspect ratio floor-to-ceiling screen, with six channels of very high quality audio. A-VISION™ is developing ATV technology and systems that are extensible up to this Showscan™ level of performance.

1.4 Aspect Ratio (AR) and Aspect Ratio Accomodation (ARA)

Aspect Ratio is one of the parameters with the largest percentage variable range to be accomodated by the ATV systems. The (4:3) aspect ratio of television and film practice is midway between the (1:1) aspect ratio that is often used in computer graphics and image processing, and the cinema-like (2:1) aspect ratio of the human field of vision.

Wider screen aspect ratios of (5:3) and (16:9) provide an increased screen width of 25% and 33% respectively, relative to the (4:3) aspect ratio found in the current practice television screen of the same screen height. The (16:9) aspect ratio recommended for HDTV is near a midpoint in the range of aspect ratios used for motion picture film that, on one extreme, extends out to a very wide (2.38:1) aspect ratio.

The aspect ratio in film is accomodated in part by the concept of an inner reticle safe-titleing / action area framed by an additional image area out to an outer aperature. ATV aspect ratio accomodation can use the same concept, and in particular the image can be framed assuming the extra width of the (16:9) wider aspect ratio, and the rest of the system use as much of the wider image as is appropriate.

Additional accomodation techniques and issues could include scaling, overscanning/underscanning, zooming, pan and scan, variable aspect ratio direct view and projection displays, as well as the effective use of a given fixed aspect ratio display format.

1.5 Binary System Compatibility and Extensibility

Toward the goal that the ATV GSA should be binary system compatible and extensible for the active video image area, it is contemplated that even the 525 line system could be extended toward the 512 active line goal, with the 483 (480-486) active lines presently used simply being a subset mode of operation.

With up to 512 pixels vertically, and up to 1024 pixels horizontally, a (2:1) aspect ratio is directly supported with square pixels, and can be extented up to 1K pixels vertically by up to 2K pixels horizontally.

By using porportionally fewer horizontal pixels, the reduced widths of the narrower (16:9), (5:3), (4:3), & (1:1) aspect ratios can be readilly accomodated while still maintaining the advantage of square pixels.

The square pixel formats also may be conventiently scaled upward or downward. Color computer displays (sequentially scanned) with 1024 by 768 pixels for the (4:3) aspect ratio are readilly available. The same color display could be used in a 1024 pixel by 576 pixel display mode to display the (16:9) aspect ratio. For very high resolution, a 2048 pixel by 1152 pixel display may be used.

If a maximum of a simple binary number of vertical pixels, such as 1K or 1024 pixels, or multiple thereof, is preferred, square pixel formats again can be accomodated using a proportionally scaled number of horizontal pixels.

The binary number of 1024 vertical pixels is eassily accomodated in the 1125/60 HDTV studio system format by simply using 1024 of the available 1035 active lines.

1.6 Transmission Bandwidths and Bandwidth Compression

Compared with the 6 MHz channels, such as NTSC which has 4.2Mhz of luminance bandwidth, the 2:1 interlaced HDTV systems start with 20Mz-30MHz, and progressively scanned HDTV systems start at twice that. Typical 1024 line high resolution computer displays have a 100 MHz order of magnitude pixel clocks, and 2K by 2K displays use 200 MHz to 400 MHz circuits with up to 600 MHz bandwidth video amplifiers. Therefore, bandwidth compression is extremely important. Significant bandwidth reduction is necessary, is possible, is likely to be available, and is referred to in the next section.

2 Rapidly Developing ATV Technologies

2.1 Global ATV Development

The pace of ATV developments is accelerating on a global scale, particularly in the recent months. This follows over twenty five years of ATV development in various areas such as television bandwidth compression.

2.2 ATV Bandwidth Compression

Bandwidth compression technologies and careful system design architectures can provide the necessary significant bandwidth reductions to provide significantly improved ATV systems at several levels. This implies significant improvements for the NTSC system, and the possibility of even greater improvements, both for other 6 MHz systems, as well as wider bandwidth systems. Bandwidth compression ratios beginning at 2:1 to 20:1 are possible and are demonstratable. Even compression ratios greater than 100:1 are possible and have been demonstrated for some applications. However this is an area requiring considerable development.

2.3 A-VISION™ ATV Systems Development

A-VISION™ is developing several ATV systems for the ATV and related industries that are described in other documents that will be available at a later date.